Science Notes:
The Sun: Earth's Energy Source

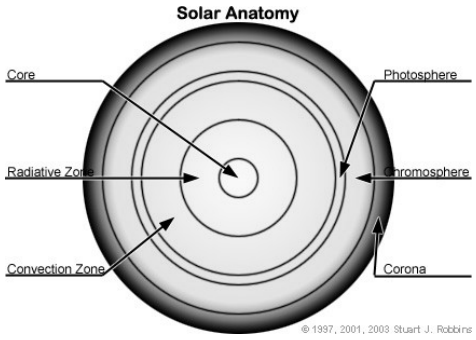
NOTE: For most of this section we will be referring to things (seasons, heat, currents, etc.) from the perspective of the hemisphere that we live in (the Northern Hemisphere). As far as seasons go, the reverse is true for the Southern Hemisphere, and you must realize that just because I refer to "we" on occasion, I am not necessarily referring to EVERYONE on earth!

Some Basics About the Sun

- As mentioned, the sun is a _____ found at the edge of our _____ galaxy.

- The sun has 3 main regions on its surface:

1. The **Photosphrere**: _____,
2. The **Chromosphere**: _____, _____. Can be seen during a total solar eclipse.
3. The **Corona**: _____.
   Can be seen during a total solar eclipse.



- The Sun's interior is heated by nuclear reactions to temperatures of 27 millions degrees F. The surface reaches temperatures of 10,000 + degrees F. The sun is made mostly of hydrogen and helium.
- The Sun has dark spots called _____ on its surface. These areas are over 3000 degrees cooler than the rest of the surface.
- Sunspots often appear in groups and reach their maximum every 11 years. Earth's weather may be warmer and stormier when sunspots are at their maximum.
- _____ are sudden eruptions on the sun's surface. They may reach 18 million degrees F.
- These flares send out streams of "charged particles" that shoot out from the sun in all

directions in what is called a solar wind. These streams can reach Earth in 21 hours. We
are shielded from these by our magnetic field.

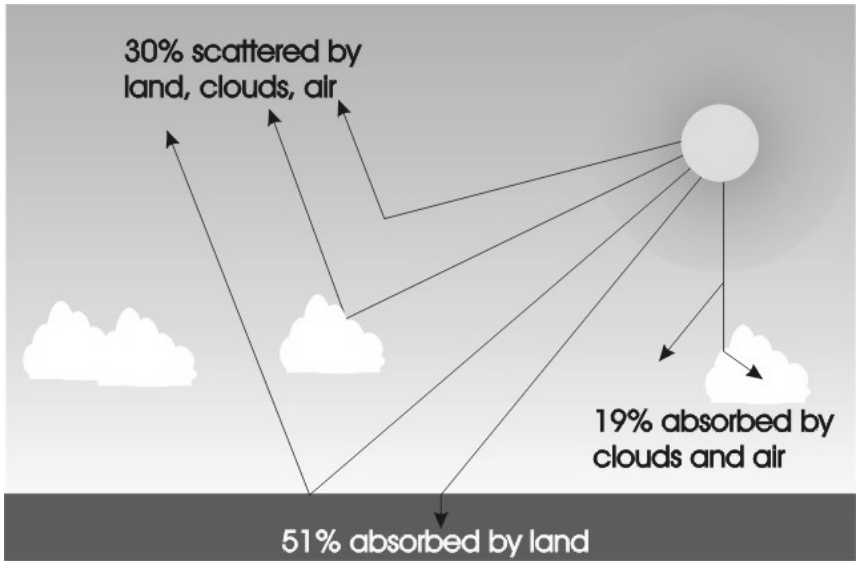
Sunlight (Solar Radiation)

- Sunlight is the Earth's _____.

  We call the energy that the sun emits _____.

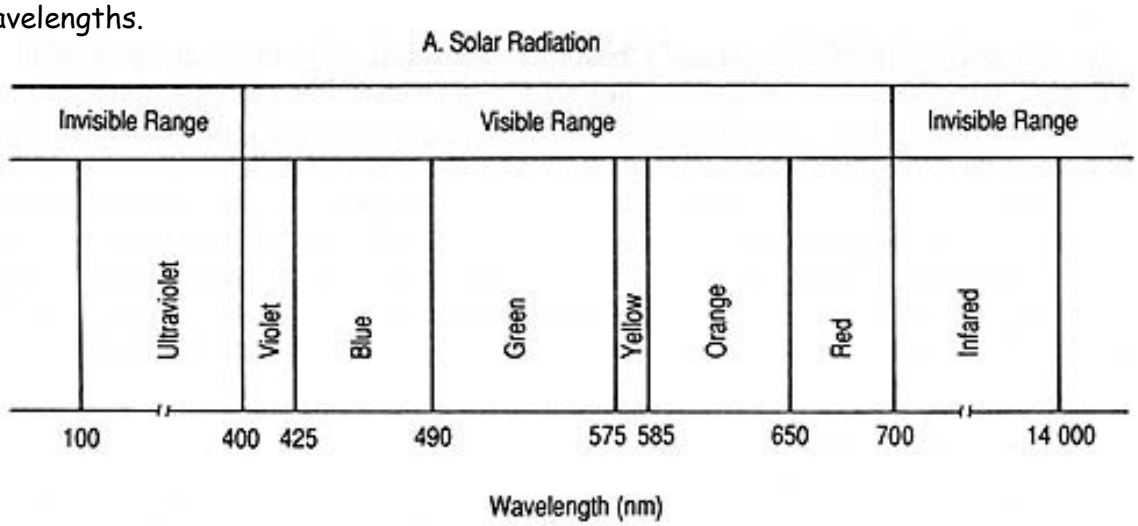
- Radiation is the _____.

- This energy comes from the sun in the form of _____, although the Earth only receives a tiny portion of it. Of this tiny portion, only a fraction of that energy actually ever gets to the Earth's surface.



Solar Radiation: The Electromagnetic Spectrum

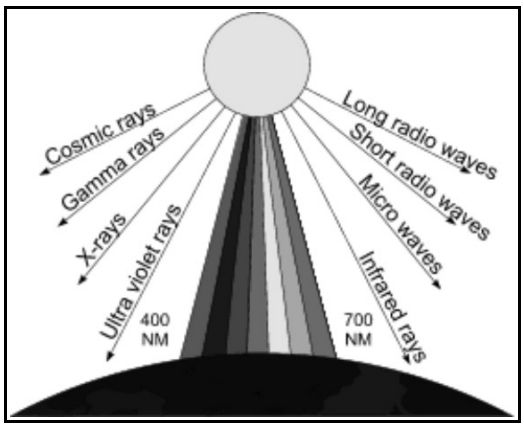
- Sunlight appears white, but actually consists of many different colors of different wavelengths.



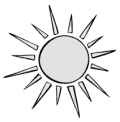
- The human eye can only see the region of the Electromagnetic Spectrum in the 400-700 nanometer (nm) range. We call this

_____

- Most of the energy from the sun arrives as short-wave radiation. This includes visible and ultraviolet light.



<u>Why are some parts of the Earth hot while others are cold?</u>



- The sun's energy strikes certain parts of the earth **<u>more directly</u>** than others. This is because the Earth is _____

- Areas near the equator, the tropics, receive _____ _____.

- Areas near the poles, the polar zones, receive _____ _____. It is these differences between the Equator and Poles that helps to drive all weather on Earth.

- Areas near the equator and poles do not experience the 4 seasons that we have here in New England.

<u>Why do we have seasons?</u>

- Areas near the equator and poles do not experience the 4 seasons that we have here in New England. However, many areas in the Temperate Zone (between 23 ½ and 66 ½ N and S of the Equator) do experience 4 seasons.

- Seasons occur mostly because of the _____

  _____.

- The hemisphere that is tilting towards the sun _____

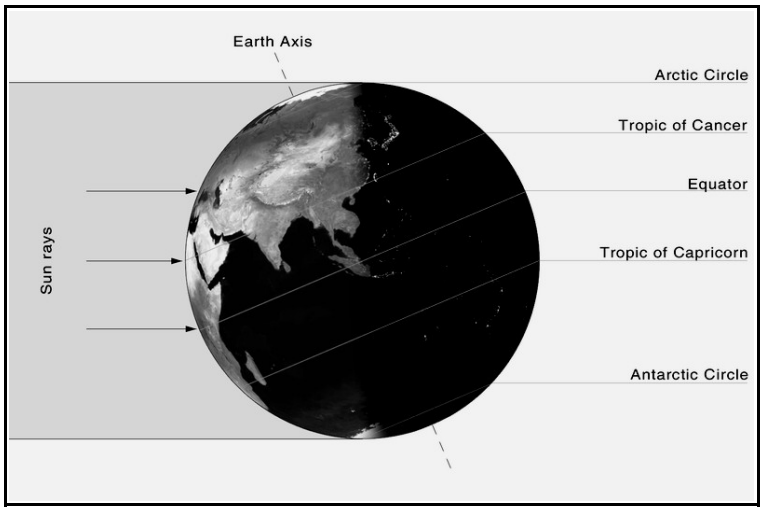
  _____

  and has _____. 

- The hemisphere that is tilting away from the sun _____

  _____

  and has _____. 



In this diagram, the Northern Hemisphere is tilting towards the sun, receiving more direct rays, and is experiencing Summer. The Southern Hemisphere is tilting away from the sun, receiving less direct rays, and is experiencing Winter.

- Note that the Southern Hemisphere always experiences seasons opposite those of the Northern Hemisphere.

- The first day of summer in the N. Hemisphere is called the _____

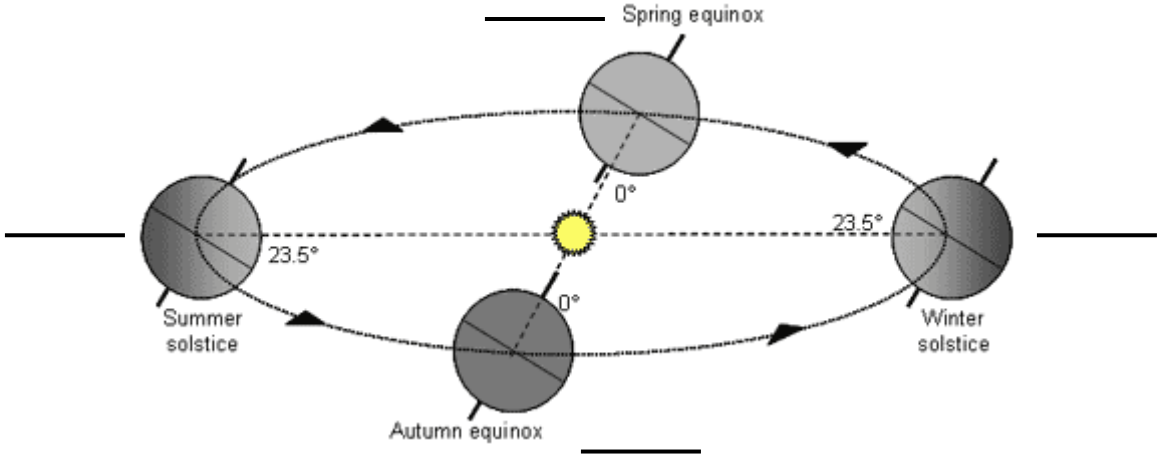
  _____. This occurs on or about _____.

We have our _____ on this day.

- The first day of winter in the Northern Hemisphere is called the _____

  _____. This occurs on or about _____.

  We have our _____ on this day.



*put dates on lines

- During the Spring and Fall, the _____is getting the _____

  _____, so the Northern and Southern Hemispheres

  experience _____.

- During the Fall it gets cooler because the day length is decreasing. The focus of the sun's direct rays is on the Equator, so each hemisphere gets about equal light/heat.

- We call the first day of Fall the _____. It happens on

  or about _____.

- During the Spring it gets warmer because the day length is increasing. The focus of the sun's direct rays is on the Equator, so each hemisphere gets about equal light/heat.

- We call the first day of Spring the _____. It happens

on or about _____.

Earth's Revolution

- The Earth takes about 365 days to _____ once around the sun (1 year).

  Because the Earth revolves around the sun, we experience a _____.

  _____.

- The Earth's orbit is _____, so during some parts of the

  year the Earth is _____.

- When the Earth is closest to the sun we call it _____. This occurs on

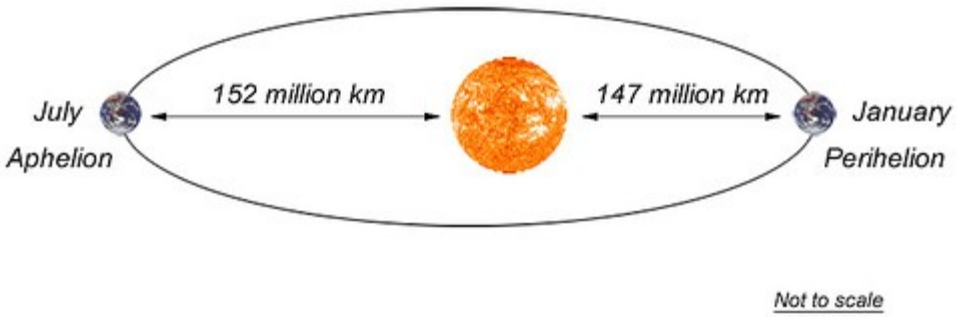
  or about _____, when the Earth and the sun are about _____

  _____.

- When the Earth is furthest from the sun we

  call it _____. This occurs on or about _____ when

  the earth and the sun are about _____.



- Scientists have calculated that there is a difference in sunlight intensity between these two periods of the year. However, the difference is roughly 7% and simply not enough of a difference to account for the seasons.

What happens to the air in the atmosphere when it is heated or cooled?

- In areas near the equator, the direct rays of the sun heat up the air quickly.

  The heated air _____

  _____.

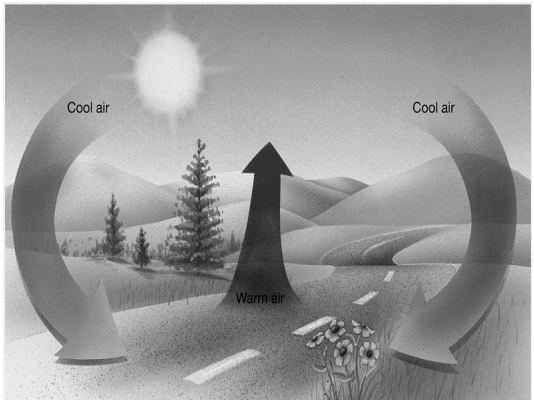
- At the poles, the cooler air _____

  _____.

- These general movements of air create global patterns of air circulation. We will discuss these later.

- All of this rising and cooling of air has a name.

- It is called _____.



- All fluids convect. This means that things like water, lava, air, etc. will rise and fall due to the influence of temperature!

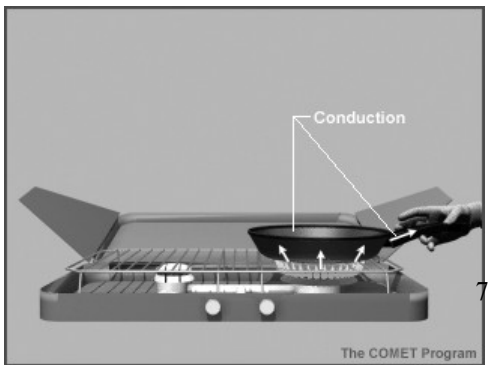
- So two of the most common ways that heat is SPREAD THROUGHOUT EARTH'S ATMOSPHERE ARE **RADIATION & CONVECTION**.

- The third way that heat is spread throughout earth's atmosphere is by **conduction**.

- **Conduction** is _____

  _____

  _____



- An example would be a metal pan touching a hot flame. An example in nature would be hot land heating up air molecules directly above it.

Global Winds

- Remember that in areas near the equator, the heated air rises and begins to head towards the north and south poles. However, this air does not simply move northward and southward.

- The earth rotates counterclockwise. This causes _____

  _____

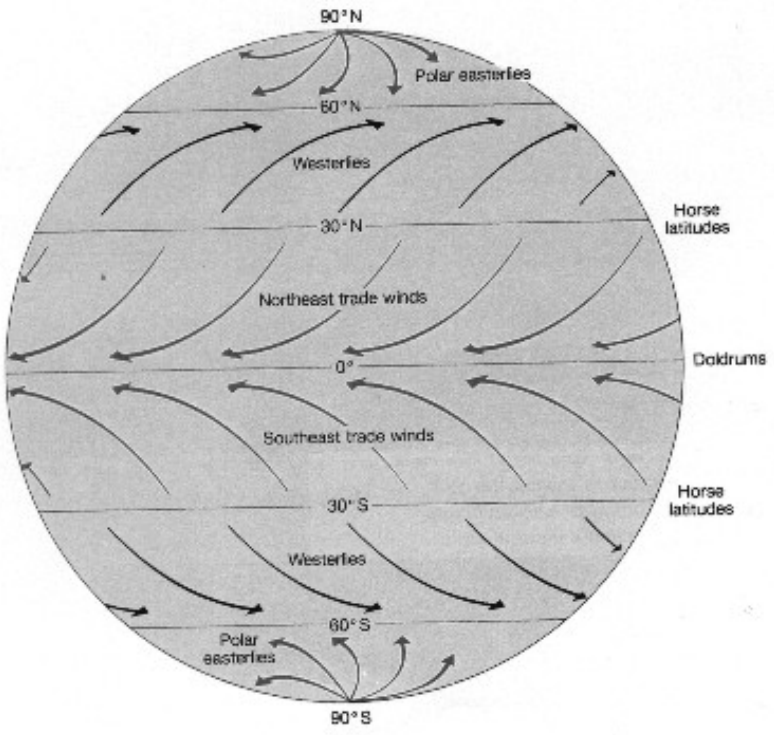
  _____

- All of the global winds in the northern hemisphere curve to the _____ as they move.

- All of the global winds in the southern hemisphere curve to the _____ as they move.

- This is known as the _____.

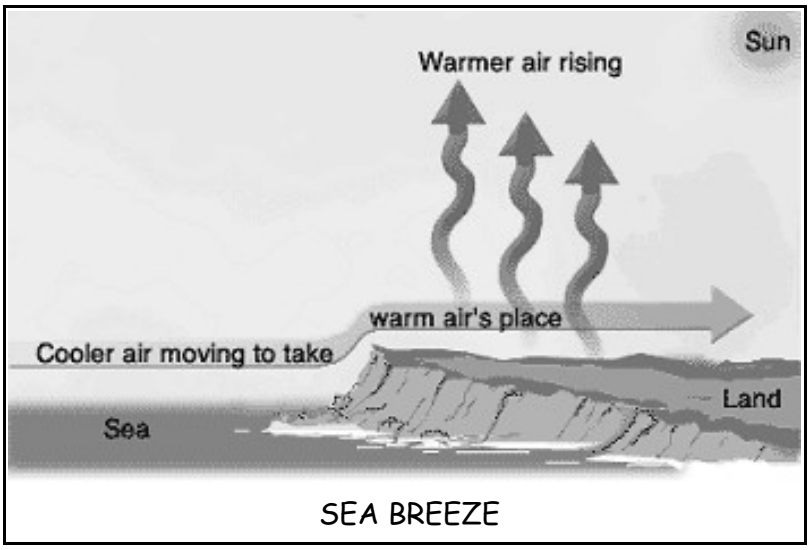
- Because of these air movements and the deflection of the air, a number of different **global wind belts** have been created on earth. These belts represent areas of earth where the prevailing winds tend to blow from a certain direction. Please refer to your handout and textbook for more information about global wind belts.



Local winds: Sea Breezes and Land Breezes

- Locally (nearby), we experience winds at the coast that are created by the temperature differences that we have talked about.

- During the daytime, the air over land is often warmer than land over the sea ***(this is because land heats up faster than water)***. The warmer air over the land **rises** and cooler air from over the water **rushes in** to take the place of the warmer air. We call this a **SEA BREEZE**.



SEA BREEZE

- During the nighttime, the air over the land is often cooler than air over a nearby water body ***(this is because water loses heat at a slower rate than land).*** The warmer air of over the water **rises** and the cooler air over land **rushes out** to take the place of the warmer air that was over the water. We call this a **LAND BREEZE**.

LAND BREEZE

Draw a picture of what you think a land breeze would look like in the box above.

Ocean Currents

- The direction of wind circulation in each hemisphere has a direct influence on the surface of currents of the ocean.

- Ocean currents are _____

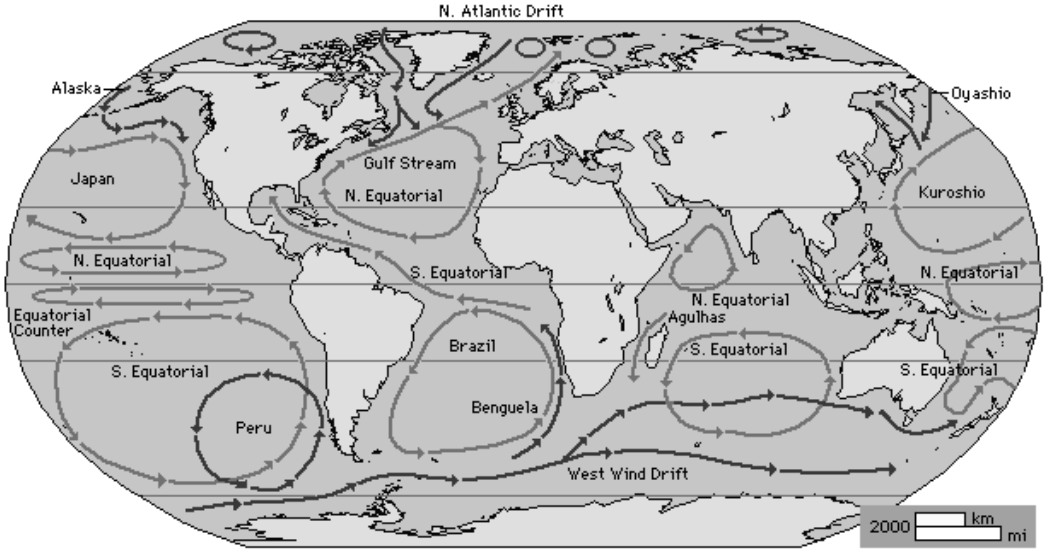
  _____.

- In the northern hemisphere the currents move clockwise, while in the southern hemisphere they move counterclockwise. Ocean currents are important factors when determining the climate of a region.

- Ocean currents can _____

  _____

  depending on where they begin.



- Ocean currents traveling away from the equator are_____

  _____ These currents help to give areas near them warmer temperatures.

- Ocean currents traveling towards the equator are_____

  _____ These currents help to give areas near them cooler temperatures.

- **Because of ocean currents, cities that are found near coastal areas are often slightly warmer (in the winter) than cities inland.**